

Chapter 1

Introduction

1-1. Purpose

This manual establishes criteria and presents guidance for geotechnical investigations during the various stages of development for civil and military projects. The manual is intended to be a guide for planning and conducting geotechnical investigations and not a textbook on engineering geology and soils exploration. Actual investigations, in all instances, must be tailored to the individual projects.

1-2. Applicability

This manual applies to all USACE Commands having either military or civil works responsibilities. The objective of Corps of Engineers Engineer Manuals (EM)¹ is to contain engineer and design technical guidance that will provide essential technical direction and application within the COE. However, an EM cannot provide the designer with two of the most vital tools essential to successful completion of a project: experience and judgement. Engineers and geologists who are just beginning their careers are strongly encouraged to seek the advice of more experienced members of their organization.

1-3. References

Standard references pertaining to this manual are listed in Appendix A. Military Standards (MIL-STD), Army Regulations (AR), Technical Manuals (TM), Engineer Regulations (ER), Engineer Manuals (EM), Engineer Pamphlets (EP), and Engineer Technical Letters (ETL) are identified in the text by the designated Government publication number or performing agency. Additional reading materials are listed in the Bibliography and are indicated throughout the manual by the principal author's last name and date of publication. Publications may be downloaded from the internet at the Corps' web page (www.usace.army.mil/inet/usace-docs/).

1-4. Background

Geotechnical investigations are performed to evaluate those geologic, seismologic, and soils conditions that affect the safety, cost effectiveness, design, and execution of a proposed engineering project. Insufficient geotechnical investigations, faulty interpretation of results, or failure to portray results in a clearly understandable manner may contribute to inappropriate designs, delays in construction schedules, costly construction modifications, use of substandard borrow material, environmental damage to the site, postconstruction remedial work, and even failure of a structure and subsequent litigation. Investigations performed to determine the geologic setting of the project include: the geologic, seismologic, and soil conditions that influence selection of the project site; the characteristics of the foundation soils and rocks; geotechnical conditions which influence project safety, design, and construction; critical geomorphic processes; and sources of construction materials. A close relationship exists between the geologic sciences and other physical sciences used in the determination of project environmental impact and mitigation of that impact. Those individuals performing geotechnical investigations are among the first to assess the physical setting of a project. Hence, senior-level, experienced personnel are required to plan and supervise the execution of a geotechnical investigation. Geotechnical investigations are to be

¹ A list of acronyms and abbreviations is included as Appendix E to this manual.

carried out by engineering geologists, geological engineers, geotechnical engineers, and geologists and civil engineers with education and experience in geotechnical investigations. Geologic conditions at a site are a major influence on the environmental impact and impact mitigation design, and therefore a primary portion of geotechnical investigations is to observe and report potential conditions relating to environmental impact. Factors influencing the selection of methods of investigation include:

- a.* Nature of subsurface materials and groundwater conditions.
- b.* Size of structure to be built or investigated.
- c.* Scope of the investigation, e.g., feasibility study, formulation of plans and specifications.
- d.* Purpose of the investigation, e.g., evaluate stability of existing structure, design a new structure.
- e.* Complexity of site and structure.
- f.* Topographic constraints.
- g.* Difficulty of application.
- h.* Degree to which method disturbs the samples or surrounding grounds.
- i.* Budget constraints.
- j.* Time constraints.
- k.* Environment requirements/consequences.
- l.* Political constraints.

1-5. Scope of Manual

Increasingly, geotechnical investigations are conducted to evaluate the condition of existing projects as part of Operations and Maintenance. This type of investigation places special constraints on the methods which may be used. These constraints should be kept in mind by the designer.

a. General. Geotechnical investigations for roads and airfields are not discussed. Geotechnical investigations at construction sites may involve exposure to hazardous and toxic waste materials. In cases where such materials are recognized, geotechnical investigators should contact the Mandatory Center for Expertise for assistance. It is of note that many of the techniques and procedures described in this manual are applicable to hazardous, toxic, and radioactive waste (HTRW) work. Geotechnical aspects of HTRW site assessment are discussed in Construction Site Environmental Survey and Clearance Procedures Manual (Draft), EM 1110-1-4000, Walker (1988), and Borrelli (1988).

b. Types of detailed discussions. Chapter 2 provides guidance on geotechnical investigations appropriate to various stages of project development. Chapter 3 provides for implementation of initial, regionally oriented geotechnical investigations. Chapter 4 provides guidance for field procedures for surface investigations. Chapter 5 provides guidance on subsurface investigation procedures. Chapter 6 describes procedures for large-scale, prototype investigations, and Chapter 7 describes laboratory

procedures for characterizing geotechnical properties of materials. Appendices and subject matter covered are: Appendix B, details for geologic mapping of construction areas; Appendix C, geologic mapping of tunnels and shafts; Appendix D, examples of drilling logs; Appendix F, soil sampling; and Appendices G and H, penetration resistance testing. Appendix F includes the modified version of the engineering manual on soil sampling. Information on soil sampling is also contained in Appendix C of EM 200-1-3. The text references specific sections of the soil sampling EM where appropriate. Guidance is in general terms where methodologies are prescribed by industry standards and described in accessible references. Where descriptions are otherwise unavailable, they are provided herein. The manual intends to provide general guidance to geotechnical investigation; because of the variability that exists among Corps of Engineers (COE) Districts or Divisions, it is advisable that each district and division prepare separate field investigations manuals. The manual should highlight procedures and formats of presentation that are preferred for geotechnical investigations within that organization. These manuals should be consistent with applicable EM.